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THE UNITED STATES STRATEGIC STOCKPILE OF CRITICAL MINERALS AND --ETC(U)
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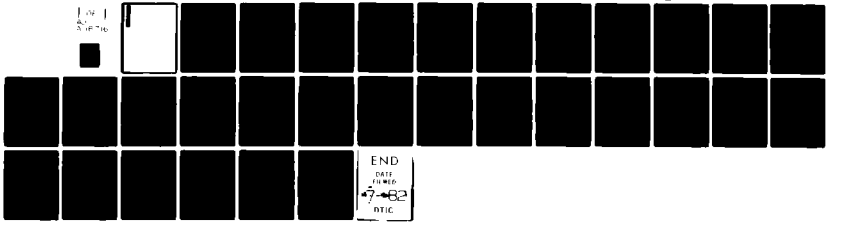

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This essay summarizes the history of the United States' stockpile of strategic and critical materials. It traces the major legislative and administration actions that have affected the stockpile and provides information to explain particular actions. Conclusions and recommendations are itemized at the end of the essay. Appendices showing external reliance and inventory status are also included.

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UNITED STATES ARMY WAR COLLEGE

CARLISLE BARRACKS, PENNSYLVANIA

THE UNITED STATES STRATEGIC STOCKPILE OF CRITICAL MINERALS AND OUR NATIONAL SECURITY

BY

LIEUTENANT COLONEL

JAMES M. HARRISON

April, 1982

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"...our survival as a leading nation depends on our mineral supplies. The close relation between minerals and our national security is too apparant to require detailed explanation."[1]

INTRODUCTION

For over 150 years, the United States was totally self-sufficient for its nonfuel mineral requirements. Today, nonfuel minerals import dependencies exist that threaten not only the United States' economic well-being, but its national security as well.[2] In the future, technological and industrialization advances will increase rather than reduce this dependency. "Never in the history of mankind have mineral resources of the earth been so essential to human existance as they are today, nor has proof of their influence upon man's progress and destiny been so obvious."[3]

The United States Government's policy of stockpiling strategic and critical materials was adopted for reasons of national security and to off-set its dependency on foreign sources. Both World War I and World War II had pointed out the dangers of assuring adequate mineral supplies across vast sea lanes during wartime. As a consequence, Congress enacted the basic Strategic and Critical Stockpile Legislation in 1946.[4] This legislation established a stockpile of minerals and materials as an insurance against dangerous and costly dependence on foreign sources during extended national emergencies. The stockpile also assures an adequate supply of strategic and critical minerals and materials for the nation's industrial base.[5]

The definition of "Strategic and critical materials are those materials required for essential uses in a war emergency, the procurement of which in adequate quantities, quality, and time is sufficiently uncertain for any reason to require prior provision for the supply thereof."[6] Although there is no distinction made between strategic and critical materials, recognition is given to various factors which would impede the rapid procurement of war-essential materials during national emergencies. "These factors include not only geographic distribution of mineral production, but also man-power and transportation difficulties and time required to create additional plant capacity and to accumulate adequate reserves."[7]

Unfortunately, the policies governing the stockpile and its strategic and critical materials have changed many times over the last 35 years. Between 1946 and 1962, vast stockpiles of minerals and materials were accumulated and stored throughout the United States. After 1962, large amounts of critical materials were sold and the stockpiles were reduced. Today, the strategic stockpile of the United States is short of its objectives both in quality and quantity of a number of critical minerals at the same time the nation is becoming dangerously dependent on foreign sources and this dependency could impact on its national security.[8] As Senator Barry Goldwater recently stated during a discussion about strategic and critical materials, "The present situation of the United States in the area of critical materials is truly a national disgrace."[9]

U.S. MINERALS VULNERABILITY

The experience of the United States with the Organization for Petroleum Exporting Countries illustrated the danger of American dependence on insecure foreign sources for important raw materials. Both our economy and standard of living have been damaged by massive price increases over the last nine years, and our national security is threatened by the problems of assuring access to an oil supply located half way around the world.

The United States currently imports approximately 40% to 50% of its oil requirements, "but it comes as a surprise to most that each American man, woman and child require the annual mining of 21,000 pounds of nonfuel minerals."[10] This is nearly one-third of the world's entire yearly output.[11] To meet its nonfuel mineral requirements, the United States must import over $25 billion dollars in minerals each year.[12] Without critical minerals such as columbium, mica, cobalt, manganese, tantalum, chromium, bauxite, nickle, strontium, platium, zinc, etc., it would be impossible to produce automobiles, televisions, jet engines, electronic equipment, missile components, machine tools, computers, batteries, stainless steel, etc. The leading U.S. manufacturer of jet engines, alone, needs 3 million pounds of cobalt per year for the JT-8 engine which is used in 83% of American commercial aircraft. The United States is currently 97% dependent on cobalt from insecure foreign sources.[13] Senator Harrison Schmidt, an experienced geologist, pointed out that "we are now more dependent on foreign

countries for our non-ferrous minerals than we are for oil and gas"... and..."a cutoff in strategic metals could be crippling."[14]

Until recently, the United States could obtain the necessary nonfuel minerals for its production base. "Multinational corporations supplied them reliably, in adequate amounts, and at competitive prices. But the economic and political order is now changing and relations between suppliers and consumers are being disrupted."[15] For example, during the 1978 civil war in Shaba province, the supply of cobalt from Zaire was disrupted for a short time. Suddenly the price of cobalt rose from $6.85 per pound to $25 per pound and even hit $50 per pound before the crisis was settled.[16] If the crisis had continued and the supply of cobalt had been completely stopped commercial aircraft in the United States would have been grounded at the rate of 25% per year.[17]

In the future, projections of world population growth and related demands on resources will raise serious questions concerning the adequacy of nonfuel minerals. It is anticipated that the world's consumption of minerals may double by 1985 and double again by the year 2000.[18]

Despite the importance and growing demand of critical nonfuel minerals, the United States must import more than 90 percent of its requirements from insecure foreign sources around the world. These requirements of critical minerals are shown on page 5.[19] A complete table of imported minerals and metals is shown at appendix 1.

NET IMPORT RELIANCE OF SELECTED CRITICAL MINERALS

(Minus Numbers Show Net Exports)

MINERAL	USSR	US	SOURCE	INDUSTRY
Columbium	0%	100%	Brazil 66%	Aerospace
Mica	10%	100%	India 83%	Electronics
Cobalt	0%	97%	Zaire 42%	Jet engines
Manganese	(-20%)	100%	Gabon 44%	Steel
Tantalum	0%	100%	Thailand 35%	Electronics
Chromium	(-44%)	100%	South Africa 40%	Stainless Steel
Bauxite	52%	100%	Jamaica 42%	Aluminum
Nickle	(-9%)	100%	Canada 52%	Steel
Stronium	0%	100%	Mexico 99%	Picture tubes
Platium	(-45%)	89%	South Africa 53%	Electronics
Zinc	(-6%)	62%	Canada 55%	Electronics
Titanium	(-9%)	46%	Japan 72%	Jet planes
Germanium	0%	62%	Germany 26%	Night Vision devices

To counter this dependency during national emergencies, President Reagan announced on 13 March, 1981, the beginning of a major purchase program for the National Defense Stockpile. In making his announcement, President Reagan said, "It is widely recognized that our nation is vulnerable to sudden shortage in basic raw materials that are necessary to our defense production base."[20]

HISTORY OF STOCKPILING

The government's stockpiling of critical materials is not new to United States history. The first administration to review critical materials and their importance was President Theodore Roosevelt's National Conservation Commission in 1909. This Commission predicted that domestic resources of petroleum and high-grade ore would be depleted by mid-century. Although numerous ideas for solving the problem were discussed, no permanent action was taken by Congress or the Executive Department.[21]

In 1921, the War Department made a study of critical minerals that were in short supply during World War I. The study was known as the Harbord List and contained some 28 different minerals that would be needed in any future war-time situation. Again, no action was taken by authorities to stockpile any type of critical materials.[22]

As war came to Europe in 1939, Congress recognized that "steps had to be taken to accumulate a reserve supply of strategic and critical materials to be available in time of emergency."[23] To meet this emergency, Congress enacted Public Law 117 and appropriated 10 million dollars for the

purchase of materials for a stockpile. The stockpile never achieved its objectives and was quickly eliminated during the early stage of World War II.

During the war, great expansion of the minerals industries took place and President Roosevelt designated over 100 different minerals and metals as war essential. Aluminum output tripled from 1942 to 1944, magnesium production showed a fiftyfold increase in five years, steel production was one-third higher in 1944 than in 1940 and large quantities of tungsten, mercury, chrome, etc. was provided. By focusing on critical materials, the United States was able to produce 45% of all the combat munitions and arms used in 1944.[24]

The supply problems encountered during World War II pointed out the need for a defense materials program to guard against similar difficulties in future national emergencies. In his message to Congress on 6 September, 1946, President Truman emphasized this problem by saying: "The development of our natural resources is.....startling. We have torn from the earth copper, iron ore, tungsten, and every mineral required to fight a war, without regard to our future supplies. We have taken what we needed. We were not able to, and we did not, take account of tomorrow."[25] To plan for any future emergencies, Congress revived Public Law 117 and on 23 July, 1946 passed Public Law 520. The intent of this Critical and Strategic Materials Stockpiling Act was to insure the availability of materials required for meeting defense and essential civilian needs during a war emergency.

As it is written the Critical and Strategic Materials Stockpiling Act of 1946 "provides that, due to the deficiencies and insufficient development of natural resources of the United States in certain strategic and critical materials necessary for the military and other needs of the country for common defense it is the policy of the Congress and the purpose and intent of the Stockpile Act to provide for:

> 1. Acquisition and retention of stocks of strategic and critical materials;
>
> 2. Encouragement of conservation and development of the sources of these strategic and critical materials within the United States and thereby decrease and prevent wherever possible the dangerous and costly dependence of the United States upon foreign nations for the supplies of these materials in times of national emergency;
>
> 3. The creation of an industry advisory committee and designated the Secretaries of War, Navy and Department of Interior to purchase and acquire the stockpiles;
>
> 4. A 5 year emergency level of materials."[26]

The General Services Administration was given the housekeeping responsibilities for the stockpiles by the Federal Property and Administrative Services Act of 1946. These duties include the actual purchase and storage of the materials. The GSA still has those responsibilities today.

Although Congress placed the procurement of materials for the stockpile in the hands of the Secretaries of War, Navy, Munitions Board and Department of Interior, numerous groups became involved in the operation.

Between 1946 and 1953, some 54 different agencies and boards of the Executive Department plus 5 interdepartmental committees, 9 legislative committees, and 10 major international groups were involved one way or another with the stockpile program.[27]

This situation continued until the Reorganization Plan No. 3 was adopted in 1953 and called for the Office of Defense Mobilization to have policy power over the stockpile program. In addition, the Executive departments were reduced from 54 to 38 and the 5 major interdepartmental committees were reduced to 1. The number of legislative committees remained the same.

The Reorganization Plan No. 3 was approved as a recommendation by the President's Materials Policy Commission, more commonly called the Paley Commission. President Truman had appointed this Commission to examine where the United States was heading in the next quarter century. The Commission convened in late 1950 and its analysis included: "mineral products underpinned the security and productivity of a free enterprise economy; the domestic resources base must be strengthened; dependence on foreign sources was a fact of life but the security of those sources remained uncertain and was destined to become a larger problem; and, to compensate for the growing complexity of the problems, government must be prepared to make decisions from a broader policy perspective."[28] The Commission also made numerous recommendations regarding the responsibilities of government and industry for improving the Nation's mineral reserve base while taking strong exception to nondevelopment in the name of

conservation. Of the 63 recommendations by the Commission, the final two are the most important. "First, the analytical capability of government must be strengthened from top to bottom, and second, the dimensions of the issues require direction by a policy group within the Executive Office of the President."[29] These recommendations were finally implemented with the adoption of the Strategic and Critical Material Stockpiling Act of 1979, 26 years after they were recommended.

A major concern of the United States between 1946 and late 1959 was its raw materials vulnerabilities. Congress passed appropriation after appropriation to build up the stocks of strategic and critical materials to levels exceeding the 5 year level.

By 1960, the need for raw materials was not as obvious and the lessons of World War I and II had been forgotten. In addition, the USSR had launched Sputnik in October of 1958 and the U.S. space program was beginning to require large amounts of money and materials. The United States made a reappraisal of its stockpile policies and decided to reduce the five year level of emergency materials to a three year level. This created a large surplus of materials and Congress debated whether the surplus stocks should be sold.

Finally in 1966-1968, during the Vietnam War, there were major releases of stockpile items. "There have been allegations that some of the releases were motivated more by the economics of the country than by National security."[30] The principal minerals involved were copper and nickle. Copper was in very short supply because of the war and prices

were rising rapidly. It was, therefore, released to defense contractors to both ease the price increases and provide needed materials for the Vietnam War. In the case of nickle, it was released out of the stockpile because of a strike in Canada. At the time, Canada was the major producer of the mineral. The minerals were never added back to the strategic stockpiles following the crisis.

The most drastic reduction in the strategic stockpiles occurred in 1973-1974 when Congress reduced the 3 year planning level to a one year level. In some cases, all stockpile holdings were liquidated such as for aluminum, copper and nickle. These reductions occurred at a time when the United States was becoming increasingly dependent on imported minerals. Again, the inventories for these minerals were not restored after they were diminished.

At the same time the stockpiles were being reduced, there was also a severe widespread shortage of minerals in the United States. This shortage was caused by a worldwide demand for minerals, a weak dollar and reduced U.S. domestic mining production.

The worldwide demand for minerals came from Japan, Germany and other industrialized nations whose economies were exploding and the weak dollar was a result of hugh trade defi-its created by the Arab oil crisis and the escalating price of oil. The Vietnam War was winding down, but it was still requiring more and more resources.

The reduced U.S. domestic mining production was precipitated by two Acts passed by Congress in 1970; The Mining and Minerals Policy Act and the Natural Materials Policy Act. The purpose of the Acts was to:

> "Enhance environment quality and conserve materials by developing a natural minerals policy to utilize preset resources and technology more efficiently, to anticipate the future materials requirements of the nation and world, and to make recommendations in the supply, use, recovery, and disposal of materials."[31]

The real consequence of these Acts, however, was to establish the National Commission on Materials Policy. Over a two year period, this Commission made 198 recommendations to Congress mainly on the side of environmentalists and conservationists. These recommendations included closing vast public lands to mining companies (in 1968, 17% of the public land was closed, by 1974, 67% was closed) and promoting strict environmental and health standards. Many of these recommendations were passed by *Congress and became laws.* Suddenly, the United States mining industries found themselves unable to economically stay in business and comply with these new health and safety standards. Between 1971 and 1973, hundreds of mines and smelters either closed down or moved their operations to foreign areas.

By late 1973, the United States was short of minerals at home and the weak dollar could not compete with the German Mark and Japanese Yen on the world markets. To overcome this serious situation, minerals were sold out of the strategic stockpiles and the money was added to the general revenue side of the budget. This action provided the needed critical minerals for the economy and helped reduce the hugh trade deficits created by the oil crisis.

By 1975, the crisis in Zaire was a major international issue and Africa, South of the Sahara was in turmoil. A number of critical nonfuel minerals needed by the United States' industrial base came from this area which included cobalt. To plan for a potential crisis, the National Security Council commissioned a study of the Nation's strategic stockpile. In the fall of 1976, a new stockpile policy was announced and new goals were established based on the old three year levels.[32]

President Carter's administration, which came into office in January of 1977, reviewed this new policy and reaffirmed it in October, 1977. However, no money was allocated for the purchase of new stocks. In fact, no significant amounts of money had been allocated for the purchase of new materials since 1960.

THE STRATEGIC AND CRITICAL MATERIALS STOCKPILING ACT OF 1979

Congress finally amended the basic Strategic and Critical Materials Stockpiling Act in 1979, after a two year review of U.S. mineral policies, and began to correct some of the deficiencies which had been identified over a 25 year period. The major aspects of the new Act include: establishing 3 years of materials to cover a national emergency; placing responsibility for the planning of the stockpile program in the hands of the Director of the Emergency Management Agency (FEMA); requiring that any items sold out of the stockpile must be approved by the Committees on Armed Services of the Senate and House of Representatives and any money received from the sale of these items will be placed in the stockpile fund

for three years and not go to the general revenue side of the budget; and the "President shall determine from time to time (1) which materials are strategic and critical for the purpose of the Act, and (2) the quality and quantity of each material to be acquired for the purposes of the Act and the form in which each material shall be acquired and stored."[33]

The Amended Act also, authorizes the President to appoint advisory committees to advise him with "respect to the acquisition, transportation, processing, refining, storage, security, maintenance, rotation, and disposal of materials."[34] To accomplish these tasks, President Reagan established the Annual Materials Plan (AMP) for the restructuring of the stockpile program. "The AMP is a list of critical stockpile materials proposed for acquisition and disposal each year through an interagency committee headed by FEMA. The agencies represented on the Committee are the Departments of Defense, Commerce, Interior, Energy, Agriculture, State and Treasury, plus the Central Intelligency Agency, the General Services Administration, and the Office of Management and Budget."[34]

The AMP process begins each budget cycle "when the FEMA gives a list of goals, deficits, excesses, and priorities to the General Services Administration. The materials proposed for purchase and/or sale are ranked according to national security priorities."[35] "The Strategic Implications Subcommittee, chaired by the Department of Defense, determines the impact of changes in defense requirements. The International Economic and Political Impacts Subcommittee, chaired by the Department of State, determines the impact of AMP proposals on international producers, trade

agreements, and foreign producer countries. The Market Impact Subcommittee, chaired by the Department of Commerce, examines the effect on commodity markets and develops the market impact statements. The Economic and Budgetary Impact Subcommittee, chaired by FEMA, examines the revenue and cost projections of the AMP proposal."[36]

"After the recommendations from the subcommittees have been incorporated, the AMP is reviewed by all member agencies. Upon inclusion of approved revisions, the Director of FEMA submits the AMP to the National Security Council and simultaneously provides a copy to the Office of Management and Budget."[37]

During the last budget cycle, the AMP Steering Committee requested $100 million of appropriations to begin rebuilding the strategic stockpiles. The money if approved will be used to purchase 1.2 million pounds of cobalt.

STOCKPILE INVENTORY OF CRITICAL MATERIALS

The current value of the United States Strategic stockpiles stored at over 100 locations is approximately 13 billion dollars.[38] Of the 93 materials, 43 are below recommended levels-including 27 materials which are below 40% of the needed amounts. See appendix 2 for a complete listing of all stockpiled items. Of particular note is that Cobalt is 44,597,607 lbs. or 48% short of its objective, Columbium is 2,339,472 lbs. or 52% short of its objective, Titanium is 162,669 short tons or 18% of its objective, Tantalum is 4,768,060 lbs. or 33% of its objective and Platium is at 35% of its objective.[39]

Although the existing inventory is valued at 13 billion dollars, 6 billion is currently excess to national security needs.[40] Presently, silver is 139,500,000 troy ounces over its objective and Industrial Diamonds which is 11,023,796 carats over objective plus several other items identified by FEMA.

In addition, many of the minerals stored in the stockpile were acquired before 1960 and technologies have changed. The type of materials and their quality no longer meet today's requirements in the sophisticated weapon systems. An example is the Aerospace cobalt requirements which are based on super-alloy needs for resistance to high temperature and corrosion. The refining of cobalt is critically important, as purity specification of above 99.5% without trace elements, are essential. The cobalt currently stored in the strategic stockpiles is not acceptable for aerospace consumption in its present condition because it is far below purity specifications.[41]

Another mineral not even stored in the stockpiles is Germanium which is used for military night vision devices. Germanium is a by product of Zinc and the total world's output is less than 100 tons. In 1978, Germanium was selling at $300 a kilo, by 1980 it rose to $1000 and in 1981 it had gone to $1240 a kilo.[42] As more and more nations begin to produce night vision devices, this mineral will become a critical material. If there had been prior planning by the Department of Defense along with the Federal Emergency Management Agency, the mineral could have been purchased and stored before it reached the stage of being critical and very expensive.

In reviewing the current inventory of the United States Strategic Stockpiles, it is evident that the materials stored are both deficient in quality and quantity and these deficiencies must be corrected in the near future or the Nation's national security could be affected.

CONCLUSIONS

---- The United States is dangerously dependent on insecure foreign sources for its critical minerals. In the future, projections of world population growth and related demands on minerals along with technological changes will increase this dependency to even more dangerous levels.

---- Policies governing the United States Strategic and Critical Stockpiles have changed many times over the last 35 years and have made the United States more dependent on insecure foreign sources rather than reduce its dependency.

---- The Mining and Mineral Policy Act and the Natural Materials Policy Act have reduced domestic mineral production in the United States.

---- The strategic stockpiles of critical minerals are short of their objectives both in quality and quantity and impacts on the nation's national security.

RECOMMENDATIONS

---- The United States must find alternate secure sources or substitutes for its critical mineral needs. The Congress should appropriate financial support to FEMA for significant research and development in this area.

---- The Executive and Congressional branches of government working with the AMP must upgrade the inventory of strategic and critical minerals without causing havoc with the world's mineral commodities market. The current inventory of the stockpiles is valued at $13 billion with $6 billion being excess to national security needs. These surpluses should be sold and the money used to purchase new quality materials. Another consideration should be bartering the surpluses such as silver with those nations that have materials which can upgrade the strategic stockpiles. In the Organic Act of the General Services Administration there is the authority to barter excess Federal property for strategic and critical materials. This authority has not been exercised since the 1950's. In the early fifties, the U.S. Government sold aluminum plants which were built during World War II to Kasier and Reynolds. In return, the United States received aluminum which went into the strategic stockpiles. Also during the 1950's, as part of the food-for-peace program and other excess agricultural commodity programs, some $2.3 billion was bartered and the United States received that value in strategic and critical materials.[43] If appropriations are not approved for upgrading the inventories, this barter option should be used as an alternative.

---- The Mining and Minerals Policy Act and the Natural Materials Policy Act have proven counterproductive to the discovery and development of domestic mineral deposits. The Congress should begin adoption of a minerals policy which takes into consideration the economic and national security of the Nation, balanced against its evironmental and conservational needs. The Congress should also consider the adoption of public land classifications which would allow mining companies to explore for critical minerals on closed public lands. The United States still knows little about the total mineral resource potential of its land. New discoveries of scarce minerals could become a reserve and the most important component in America's mineral future.

---- The United States must adopt a clear and coherent minerals policy to deal with the world it will confront in 1990 or 2000. This minerals policy should not be a policy of reaction, but rather a policy of steady commitment that recognizes the indispensability of minerals to the Nation's industrial base and its national security.

---- The Department of Defense can no longer act as a consuming bystander concerning national mineral policy. As new weapons systems are designed, minerals that are vital to those systems must be identified and stored for future use. The Defense Department must work closely with the Executive Department and FEMA to identify critical minerals needs for the United States' national security.

APPENDIX 1

NET IMPORT RELIANCE OF SELECTED MINERALS AND METALS
(Minus numbers show net exports)

Mineral	USSR	U.S.	Japan	Europe
Columbium	0	100	100	100
Mica	10	100	100	100
Strontium	0	100	0	0
Cobalt	0	97	100	100
Manganese	(-20)	98	95	100
Tantalum	0	96	100	0
Bauxite	52	93	100	83
Chromium	(-44)	90	99	100
Platium	(-45)	89	98	100
Asbestos	(-32)	85	97	83
Fluorine	50	82	100	8
Tin	21	81	98	96
Nickle	(-9)	77	100	100
Cadium	(-29)	66	(-5)	70
Zinc	(-6)	62	61	71
Potassium	(-42)	66	0	0
Selenium	0	40	(-123)	83
Mercury	0	62	0	79
Gold	(-145)	56	95	99
Tungsten	12	59	51	93
Antimony	19	43	100	95
Silver	(-10)	45	60	85
Barium	51	40	(-19)	20
Titanium	(-9)	46	100	0
Gypsum	0	33	2	1
Iron Ore	(-20)	28	99	70
Vanadium	(-31)	25	100	0
Copper	(-3)	13	91	100
Lead	(-17)	11	76	36
Alumium	(-44)	8	28	76

NATIONAL DEFENSE STOCKPILE INVENTORY OF STRATEGIC AND CRITICAL MATERIALS

March 31, 1981

Commodity	Unit	1980 Goal	Inventory	Value of Inventory (Millions $)	Quantity After Crediting Offset Excess	Deficit
1. Aluminum Metal Group	**ST Al Metal**	**7,150,000**	**3,444,064**	**551.3**		**3,705,936**
Alumina	ST	0	0	-		-
Aluminum	ST	700,000	1,733	2.6		698,267
Bauxite, Metal Grade, Jamaica Type	LDT	21,000,000	8,858,881	334.1		12,141,119
Bauxite, Metal Grade, Surinam Type	LDT	6,100,000	5,299,596	214.6		800,404
2. Aluminum Oxide, Abrasive Grain Group	**ST Ab Grain**	**638,000**	**259,124**	**124.0**		**378,876**
Aluminum Oxide, Abrasive Grain	ST	0	50,904	59.0	a	
Aluminum Oxide, Fused, Crude	ST	0	249,867	65.0	a	
Bauxite, Abrasive Grade	LCT	1,000,000	0	-		a
3. Antimony	**ST**	**36,000**	**40,730**	**162.9**	**4,730**	
4. Asbestos, Amosite	**ST**	**17,000**	**42,534**	**21.9**	**25,534**	
5. Asbestos, Chrysotile	**ST**	**3,000**	**9,958**	**8.9**	**6,958**	
6. Bauxite, Refractory	**LCT**	**1,400,000**	**174,599**	**34.0**		**1,225,401**
7. Beryllium Metal Group	**ST Be Metal**	**1,220**	**1,061**	**176.6**		**159**
Beryl Ore (11% BeO)	ST	18,000	17,987	22.8		13
Beryllium Copper Master Alloy	ST	7,900	7,387	74.6		513
Beryllium Metal	ST	400	229	79.2		171
8. Bismuth	**LB**	**2,200,000**	**2,081,298**	**5.2**		**118,702**
9. Cadmium	**LB**	**11,700,000**	**6,328,809**	**12.7**		**5,371,191**
10. Castor Oil (Sebacic Acid)	**LB**	**22,000,000**	**12,524,243**	**9.4**		**b**
11. Chromium, Chemical and Metallurgical Group	**ST Cr Metal**	**1,353,000**	**1,173,230**	**1,048.0**		**179,770**
Chromite, Chemical Grade Ore	SDT	675,000	242,414	14.3		c
Chromite, Metallurgical Grade Ore	SDT	3,200,000	2,488,043	260.8		c
Chromium, Ferro, High Carbon	ST	185,000	402,696	279.2	c	
Chromium, Ferro, Low Carbon	ST	75,000	318,892	418.1	c	
Chromium, Ferro, Silicon	ST	90,000	58,355	43.6		c
Chromium, Metal	ST	20,000	3,763	32.0		c
12. Chromite, Refractory Grade Ore	**SDT**	**850,000**	**391,414**	**36.9**		**458,586**

Commodity	Unit	1980 Goal	Inventory	Value of Inventory (Millions $)	Quantity After Crediting Offset Excess	Quantity After Crediting Offset Deficit
13. Cobalt	LB Co	85,400,000	40,802,393	816.1		44,597,607
14. Columbium Group	LB Cb Metal	4,850,000	2,510,528	33.8		2,339,472
Columbium Carbide Powder	LB Cb	100,000	21,372	.6		78,628
Columbium Concentrates	LB Cb	5,600,000	1,780,463	25.5		d
Columbium, Ferro	LB Cb	0	930,911	5.9	d	
Columbium, Metal	LB Cb	0	44,851	1.8	d	
15. Copper	ST	1,000,000	29,048	57.3		970,952
16. Cordage Fibers, Abaca	LB	155,000,000	0	-		155,000,000
17. Cordage Fibers, Sisal	LB	60,000,000	0	-		60,000,000
18. Diamond, Industrial Group	KT	29,700,000	42,429,314	478.6	12,729,314	
Diamond Dies, Small	PC	60,000	25,473	1.1		34,527
Diamond, Industrial, Crushing Bort	KT	22,000,000	23,692,782	60.4	1,692,782	
Diamond, Industrial, Stones	KT	7,700,000	18,723,796	417.1	11,023,796	
19. Feathers and Down	LB	1,500,000	0	-		1,500,000
20. Fluorspar, Acid Grade	SDT	1,400,000	895,983	125.4		504,017
21. Fluorspar, Metallurgical Grade	SDT	1,700,000	411,738	40.1		1,288,262
22. Graphite, Natural, Ceylon, Amorphous Lump	ST	6,300	5,498	5.2		802
23. Graphite, Natural, Malagasy, Crystalline	ST	20,000	17,914	11.9		2,086
24. Graphite, Natural, Other than Ceylon & Malagasy	ST	2,800	2,804	.5	4	
25. Iodine	LB	5,800,000	8,013,074	57.1	2,213,074	
26. Jewel Bearings	PC	120,000,000	69,077,325	67.0		50,922,675
27. Lead	ST	1,100,000	601,036	432.7		498,964
28. Manganese, Dioxide, Battery Grade Group	SDT	87,000	243,710	22.7	156,710	
Manganese, Battery Grade, Natural Ore	SDT	62,000	240,699	19.7	e	
Manganese, Battery Grade, Synthetic Dioxide	SDT	25,000	3,011	3.0		e

Commodity	Unit	1980 Goal	Inventory	Value of Inventory (Millions $)	Quantity After Crediting Offset Excess	Quantity After Crediting Offset Deficit
29. Manganese, Chemical & Metallurgical Group	ST Mn Metal	1,500,000	1,586,353	530.9	86,353	
Manganese Ore, Chemical Grade	SDT	170,000	221,044	18.1	51,044	
Manganese Ore, Metallurgical Grade	SDT	2,700,000	3,378,141	186.2		f
Manganese, Ferro, High Carbon	ST	439,000	599,978	273.2	f	
Manganese, Ferro, Low Carbon	ST	0	0	-	-	
Manganese, Ferro, Medium Carbon	ST	0	28,920	22.0	f	
Manganese, Ferro, Silicon	ST	0	23,574	11.6	f	
Manganese Metal, Electrolytic	ST	0	14,172	19.8	f	
30. Mercury	FL	10,500	191,391	79.4	180,891	
31. Mica Muscovite Black, Stained & Better	LB	6,200,000	5,212,444	27.8		987,556
32. Mica Muscovite Film, 1st & 2nd Qualities	LB	90,000	1,274,489	14.9	1,184,489	
33. Mica Muscovite Splittings	LB	12,630,000	19,035,162	38.1	6,405,162	
34. Mica Phlogopite Block	LB	210,000	130,745	.1		79,255
35. Mica Phlogopite Splittings	LB	930,000	1,918,265	2.0	988,265	
36. Molybdenum Group	LB Mo	0	0	-	-	
Molybdenum Disulphide	LB Mo	0	0	-	-	
Molybdenum, Ferro	LB Mo	0	0	-	-	
37. Nickel	ST Ni+Co	200,000	0	-		200,000
38. Opium Group	AMA LB	130,000	71,303	29.6		58,697
Opium, Gum	AMA LB	0	31,795	6.7	g	
Opium, Salt	AMA LB	130,000	39,508	22.9		g
39. Platinum Group Metals, Iridium	Tr Oz	98,000	16,991	10.2		81,009
40. Platinum Group Metals, Palladium	Tr Oz	3,000,000	1,255,003	175.7		1,744,997
41. Platinum Group Metals, Platinum	Tr Oz	1,310,000	452,640	215.0		857,360
42. Pyrethrum	LB	500,000	0	-		500,000
43. Quartz Crystals	LB	600,000	2,423,135	14.5	1,823,135	
44. Quinidine	Av Oz	10,100,000	1,800,462	7.7		8,299,538

Commodity	Unit	1980 Goal	Inventory	Value of Inventory (Millions $)	Quantity After Crediting Offset Excess	Deficit
45. Quinine	Av Oz	4,500,000	3,246,164	10.4		1,253,836
46. Rubber	LT	850,000	119,208	172.2		730,792
47. Rutile	SDT	106,000	39,186	12.7		66,814
48. Sapphire and Ruby	KT	0	16,305,502	.2	16,305,502	
49. Silicon Carbide, Crude	ST	29,000	80,550	36.2	51,550	
50. Silver, Fine	Tr Oz	0	139,500,000	1,848.4	139,500,000	
51. Talc, Steatite Block & Lump	ST	28	1,092	.4	1,064	
52. Tantalum Group	LB Ta Metal	7,160,000	2,391,940	343.9		4,768,060
Tantalum, Carbide Powder	LB Ta	0	28,688	5.0	h	
Tantalum Metal	LB Ta	0	201,133	28.2	h	
Tantalum Minerals	LB Ta	8,400,000	2,551,302	310.7		h
53. Thorium Nitrate	LB	600,000	7,141,812	19.6	6,541,812	
54. Tin	LT	42,000	200,112	2,900.6	158,112	
55. Titanium Sponge	ST	195,000	32,331	440.3		162,669
56. Tungsten Group	LB W Metal	50,666,000	80,814,761	861.8	30,148,761	
Tungsten Carbide Powder	LB W	2,000,000	2,032,942	30.2	i	
Tungsten, Ferro	LB W	0	2,025,361	24.1	i	
Tungsten, Metal Powder	LB W	1,600,000	1,898,911	26.4	i	
Tungsten Ores & Concentrates	LB W	55,450,000	87,964,215	781.1	i	
57. Vanadium Group	ST V Metal	8,700	541	5.9		8,159
Vanadium, Ferro	ST V	1,000	0	-		1,000
Vanadium Pentoxide	ST V	7,700	541	5.9		7,159
58. Vegetable Tannin Extract, Chestnut	LT	5,000	16,717	9.0	11,717	
59. Vegetable Tannin Extract, Quebracho	LT	28,000	142,691	84.2	114,691	
60. Vegetable Tannin Extract, Wattle	LT	15,000	16,398	9.2	1,398	
61. Zinc	ST	1,425,000	375,970	320.5		1,049,030

ENDNOTES

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